

## TRAVEL TOOTHBRUSH ASSEMBLY

## CROSS REFERENCE TO RELATED APPLICATION

This Application claims priority under 35 U.S.C. §119(e) to U.S. Provisional Application No. 60/320,224, filed May 27, 2003, which is hereby incorporated herein  
5 by reference in its entirety.

## TECHNICAL FIELD

This invention relates to toothbrushes with paste dispensing and in particular to travel toothbrushes that are sealed and provide toothpaste dispensing through the toothbrush bristles and provide for easy loading of toothbrush with toothpaste directly  
10 from a toothpaste tube. This invention relates to travel-ready toothbrushes. More specifically, this invention is an assembly used to construct self-dispensing, leakage-free, refillable toothbrushes with replaceable bristles. The assembly described in this invention is incorporated into various toothbrush designs. Toothbrushes that use this assembly can then be styled to emulate a variety of common and stylized objects such  
15 as a pen, a cigar, a make-up applicator, or other cylindrical objects.

## BACKGROUND INFORMATION

Toothbrushes with self-dispensing toothpaste chambers have been suggested that combine the toothbrush and toothpaste container into one object. This eliminates the need for the user to carry both a toothbrush and toothpaste container and enables  
20 the user to conveniently brush wherever a water supply is available. Previous designs, however, do not lend themselves to versatility whereby a variety of different styled toothbrushes can be constructed using interchangeable parts. Patents that describe travel-ready, self-dispensing toothbrushes as finished products are not intended to be used as subassemblies or components. Therefore, the nature of those designs differs  
25 from this patent, which is used as a building block for constructing various finished toothbrush designs.

Several patents relating to travel-ready, self-dispensing toothbrushes are described below. One of the most popular travel ready, self-dispensing toothbrush is described in U.S. Re. Pat. No. 6,142,694. The invention describes a finished toothbrush and not a subassembly. In addition, the functionality of this toothbrush has several drawbacks. First is the fact that the toothbrush is disposable and not refillable. The user is not able to choose the brand of toothpaste used. In addition, the disposable nature necessitates the use of lower quality, low usage bristles. Another drawback is that this toothbrush is prone to water leakage and does not lend itself to being carried in the pocket of an expensive garment, handbag, or computer case without a watertight container. Another drawback is that that toothbrush is not appealing to the discretionary user.

There are two fundamental problems with prior art designs. First the dispensing portion of the toothbrush assembly is not designed to be disassembled. Toothpaste is a material that has different qualities and with time may tend to clog or get too rigid to be properly dispensed. A workable dispensing toothbrush assembly needs to be designed so that it can be disassembled for cleaning. Secondly, the chamber that holds the toothpaste also holds the elements that are used to facilitate loading toothpaste into the chamber and dispensing toothpaste from the chamber. Prior art designs did not isolate the toothpaste holding chamber from the elements that dispensed the toothpaste. For example, most designs have a threaded shaft that extends into the toothpaste and also engages threads in the element used to push toothpaste from the chamber. This threaded shaft may get contaminated with material that gets transferred to the toothpaste.

There is, therefore, a need for a toothbrush assembly comprising a threaded toothbrush head section, a delivery tube integral to the threaded toothbrush head section for delivering toothpaste to the top of the toothbrush bristles, and a chamber section operable for storing toothpaste and selectively receiving toothpaste from a toothpaste tube and delivering the toothpaste to the toothbrush bristles or back to the

toothpaste tube. The toothbrush assembly needs to be made of component parts such that the chamber section can be disassembled for cleaning.

## SUMMARY OF THE INVENTION

A toothbrush assembly is made with three main elements, a toothbrush head section that incorporates toothbrush bristles, a toothpaste holder section, and a leak proof cap. The toothbrush head section has bristles on a bristle end and a shaft connecting the bristle end to a threaded end. The shaft has an encased channel extending from the threaded end to substantially the center of the bristles on the bristle end. A flexible tube extends from an opening in the channel to substantially the top of the bristles. The flexible tube is sufficiently flexible that it does not interfere with the action of the bristles when brushing teeth. The threaded end toothbrush head has male threads for mating to female threads in a threaded opening in a chamber in the toothpaste holder section. The chamber also has a plunger end opening for receiving a plunger assembly having a plunger head that seals against the sides of the chamber.

The plunger assembly is made of component parts including a plunger head, a plunger body and a twist knob coupled to a threaded shaft. The plunger head is cylindrical with compliant seal features around its circumference that fits against and seals to the inside of the chamber. The plunger head is coupled to and retained by features on the plunger end of the plunger body. The plunger body has a non-cylindrical threaded shaft that has opposing threaded sections along its length. The threaded sections are on circumferential sections of the threaded shaft and allow a nut to be threaded and supported. The threaded shaft of the plunger body is non-cylindrical with surfaces and features that allow it to translate but not rotate relative to the twist knob to which it is coupled. The nut is threaded onto the threaded shaft until it is stopped by a flange on the plunger end. The twist knob has a cavity with inside surfaces and features that mate to the threaded shaft. The shaft of the plunger body and its engagement with mating features in the cavity of the twist knob allow the plunger body to smoothly translate within the cavity. When the plunger body is inserted into the chamber, the nut is stopped by a flange in the inside of the chamber. Features on the twist knob coupled to mating features on the inside of the chamber

thereby retaining the plunger assembly while allowing the twist knob to rotate with respect to the chamber. When the twist knob is rotated, the plunger body is likewise rotated. Since the nut is stopped by a flange on the inside of the chamber, the force of the threads cause the shaft of the plunger body to translate with respect to the nut and thus into the chamber. The sealed plunger head is the only moving part that is exposed to the inside of the chamber.

The twist knob is coupled to a threaded shaft such that rotating the twist knob in a first rotary direction operates to laterally move the plunger head toward the threaded opening and in a second rotary direction operates to laterally move the plunger towards the plunger opening. Moving the plunger head, sealed against the sides of the chamber, operates to pull a vacuum on the chamber when moved in the first direction and to pressurize the chamber when moved in the second direction. A standard off-the-shelf toothpaste tube may be threaded into the threaded end of the chamber and toothpaste may be extracted from the toothpaste tube into the chamber or delivered from the chamber back into the toothpaste tube. After the chamber has been loaded with toothpaste and a toothbrush head section has been threaded into the threaded end, the twist knob delivers toothpaste from the chamber to the top of the toothbrush bristles when rotated in the second rotary direction. The outside surface of the chamber has features that retain the cap that fits over the toothbrush head section and prevents leakage of any water or toothpaste remaining in the bristles after use. A universal adapter has threads matching the threaded end and a compliant opening for mating to a variety of off-the-shelf toothpaste tubes.

The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

5           Figure 1A is a view the toothbrush assembly according to embodiments of the present invention showing the toothbrush head section attached to the toothpaste holder section with the cap removed;

FIG. 1B is a view of the toothbrush assembly with the cap attached.

10           FIG. 2 is an exploded view of the toothbrush assembly according to embodiments of the present invention;

FIG. 3 is a section view of the toothbrush assembly of FIG. 2;

FIGS. 4A, 4B, 4C and 4D are various views of the plunger body of the plunger assembly used in the toothbrush assembly of FIG. 2;

15           FIGS. 5A and 5B are various views of the plunger head of the plunger assembly used in the toothbrush assembly of FIG. 2;

FIGS. 6A and 6B are various views of the nut of the plunger assembly used in the toothbrush assembly of FIG. 2;

FIGS. 7A, 7B, 7C and 7D are various views of the twist knob of the plunger assembly used in the toothbrush and assembly of FIG. 2;

20           FIGS. 8A, 8B, and 8C are various views of the chamber of the toothpaste holding section of the toothbrush assembly of FIG. 2;

FIGS. 9A and 9B are views of the O-ring for sealing the cap of the toothbrush assembly of FIG. 2;

25           FIGS. 10A, 10B, and 10C are various views of the toothbrush head section of the toothbrush assembly of FIG. 2;

FIGS. 11A, 11B, and 11C are various views of the cap for the toothbrush assembly of FIG. 2;

FIGS. 12A, 12B, and 12C are various views of the flexible tube of the toothbrush head section;

FIG. 13 is a clip used in the cap of the toothbrush assembly of FIG. 2;

FIGS. 14A, 14B, and 14C are various views of the universal adapter used with embodiments of the present invention;

5 FIG. 14D illustrates a toothpaste tube coupled to the toothpaste holding section of the toothbrush assembly of FIG. 2 using the universal adapter illustrated in FIGS. 14A, 14B, and 14C; and

FIGS. 15A and 15B illustrate various views of another embodiment of the present invention.

## DETAILED DESCRIPTION

In the following description, numerous specific details are set forth to provide a thorough understanding of the present invention. However, it will be obvious to those skilled in the art that the present invention may be practiced without such specific details. In other instances, well-known devices may be shown in block diagram form in order not to obscure the present invention in unnecessary detail. For the most part, details concerning materials and processes and the like have been omitted inasmuch as such details are not necessary to obtain a complete understanding of the present invention and are within the skills of persons of ordinary skill in the relevant art.

The modular and interchangeable design of the toothpaste holder section, plunger assembly, and toothbrush head section enables toothpaste dispensing toothbrushes to be inexpensively manufactured in a variety of styles and colors using distinctive handles and protective caps. The plunger assembly offers a mechanism for finely controlling the flow of toothpaste. The replaceable toothbrush head section enhances the reusability and longevity of the toothbrush. A chamber in the toothpaste holder section that holds the toothpaste is isolated from moving parts in the plunger assembly reduces the chance of clogging, contamination of the toothpaste, and toothpaste leakage. The plunger assembly may be easily removed from the chamber and disassembled for cleaning.

Refer now to the drawings wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by the same reference numeral through the several views.

FIG. 1A is a view of the toothbrush assembly 100 according to embodiments of the present invention. Toothbrush assembly 100 comprises the cap 109 and two primary sections; toothbrush head section (toothbrush head) 101 and toothpaste holder section 102. Toothbrush head 101 comprises bristles 106 on the bristle end and a shaft 107 connecting the bristle end to the threaded end. The threads of the



threaded end are not shown in this view. Shaft 107 has an encased channel (not shown) that extends from the bristle end to the threaded end. A flexible tube 104 is coupled to a brush opening (not shown) in the encased channel and extends to substantially the top of the bristles 106. In this way, toothpaste (not shown) may be deposited on the top of the bristles avoiding waste. Flexible tube 104 is sufficiently flexible such that it does not interfere with the action of the bristles 106 when brushing. Also shown in this view are a twist knob 103 which is coupled to a plunger head (not shown in this view) that operates inside toothpaste chamber 105 of toothpaste holder section 102. Cap 109 with clip 108 is also shown in this view.

FIG. 1B illustrates the toothbrush assembly 100 with cap 109 coupled to toothpaste holder section 102. The outside of toothpaste chamber 105 and twist knob 103 are shown in this view.

FIG. 2 is an exploded view of all the elements of toothbrush assembly 100. Plunger assembly 200 comprises a plunger head 203, plunger body 204, threaded nut 205 and twist knob 103. Plunger assembly 200 is inserted into plunger end 208 of toothpaste chamber 105. O-ring 202 is coupled to a groove (not shown) on brush end 209 of toothpaste chamber 105. O-ring 202, toothpaste chamber 105 and plunger assembly 200 make up toothpaste holder section 102 of toothbrush assembly 100. Toothbrush head 101 comprises bristles 106 coupled to threaded end 206 with shaft 107. Flexible tube 104 couples to brush opening 207 and extends substantially to the top of bristles 106.

FIG. 3 is a section view of toothbrush assembly 100. Cap 109 with clip 108 extends over bristles 106 and shaft 107 and couples to features 302 on toothbrush head 101. Cap 109 seals against O-ring 202 to prevent leakage of any fluid left in bristles 106 after use. Opening 305 in brush end 209 accesses toothpaste chamber volume 301. Toothpaste (not shown) is disposed into toothpaste chamber volume 301. Plunger head 203 is the only moving part of toothbrush assembly 100 that comes in contact with toothpaste in toothpaste chamber volume 301. Seal features

306 extend around plunger head 203 and seal against the inside wall of toothpaste chamber 105. Plunger head 203 is coupled to an retained by features on plunger body 204. Nut 205 is threaded onto threads of plunger body 204 and is stopped by flange 307. A front surface of nut 205 also seats against an inside lip on toothpaste chamber 105. Plunger body 204 extends inside a recess of twist knob 103. Features 308 on twist knob 103 couple to mating features in plunger end 208 of toothpaste chamber 105. Twist knob 103 is free to rotate relative to toothpaste chamber 105 while coupled. When twist knob 103 is over plunger body 204 and coupled to features 308 on toothpaste chamber 105, it contacts and retains nut 205 from any lateral motion. Plunger head 203 moves laterally between plunger end 208 and toothbrush end 209 of toothpaste chamber 105 by the action of nut 205 and threads on plunger body 204 when twist knob 103 is rotated. Features of twist knob 103 (not shown) prevent plunger body 204 from rotating with respect to twist knob 103.

FIGS. 4A, 4B, 4C and 4D illustrate details of plunger body 204. Plunger body 204 does not have a cylindrical cross section. The embodiment of Figure 4 illustrates plunger body 204 with a rectangular cross section 405. Two sets of threads 401 are diametrically opposed on plunger body 204 and conform to a circumference 406 that is tangential to the cross section of plunger body 204. A mating recess to cross section 405 in twist knob 103 allows plunger body 204 to translate but not rotate within twist knob 103. Plunger head 203 fits over end 403 of plunger body 204. Flange 307 stops nut 205 when it is threaded on threads 401 of plunger body 204. Surfaces 404 (on each side of plunger body 204) serve to guide plunger body 204 when it moves laterally and aids in preventing binding.

FIGS. 5A and 5B illustrate details of plunger head 203. Surface 501 of plunger head 203 is the only moving part that contacts toothpaste in toothpaste chamber volume 301. Seal features 306 act like three O-rings and seal against the inside wall of toothpaste chamber 105.

FIGS. 6A and 6B illustrate details of nut 205 of plunger assembly 200. Nut 205 has features 602 that fit into mating features on the inside wall of toothpaste chamber 105 and prevent nut 205 from rotating in toothpaste chamber 105 when plunger assembly 200 is inserted in and coupled to toothpaste chamber 105 with features 308. Surface 603 of nut 205 contacts flange 307 on plunger body 204. Threads 601 mate with threads 401 on plunger body 204.

FIGS. 7A, 7B, and 7C illustrate details of twist knob 103 for toothbrush assembly 100. Recess 702 receives plunger body 204. Recess 702 has features 703 that mate with grooves 402 in plunger body 204 and aids guiding plunger body 204 in recess 702 when it moves laterally.

FIGS. 8A, 8B, and 8C illustrate details of toothpaste chamber 105. Toothpaste chamber 105 has brush end 801 and plunger end 208. Grooves 808 mate with corresponding features 602 on nut 205 preventing nut 205 from rotating within toothpaste chamber 105. Groove 808 holds and retains O-ring 202. Feature 804 in toothpaste chamber 105 mates with features 308 on twist knob 204. Toothpaste chamber volume 301 is modified by lateral motion of plunger head 203.

FIGS. 9A and 9B illustrate details of O-ring 202. O-ring 202 stretches and fits into groove 805 in toothpaste chamber 105. Inside 902 contacts the bottom of groove 805 and outside 901 contacts the inside wall of cap 109.

FIGS. 10A, 10B, and 10C illustrate details of toothbrush head 107. Holes 1004 are for receiving bristles 106. Opening 207 receives flexible tube 104. Encased channel 304 extends from opening 207 to opening 1003. Threads 206 mate with corresponding threads in toothpaste holder section 102. Threads 206 may be made compatible with one of the many off-the-shelf toothpaste tubes on the market.

FIGS. 11A, 11B, and 11C illustrate details of cap 109 for toothbrush assembly 100. Cap 109 has holes 1103 for receiving mating features of clip 108. Feature 1202

is a groove for coupling to feature 302 on toothbrush head 101. Opening 1201 extends over toothbrush head 101.

FIGS. 12A, 12B, and 12C illustrate details of flexible tube 201 that fits into opening 207 in toothbrush head 101. Flange 1202 fits into a mating groove retaining flexible tube 104 in toothbrush head 101 so that it is secure during brushing with bristles 106. Opening 1201 delivers toothpaste to substantially the top of bristles 106.

FIG.13 illustrates details of clip 108 for toothbrush assembly 100. Features 1301 couple and retain clip 108 to cap 109.

FIG. 14A illustrate details of a universal adapter 1400 used with embodiments of the present invention.

FIG. 14B illustrates toothpaste tube 1403 coupled to the threaded end 209 of toothpaste chamber 105 with universal adapter 1400.

FIGS. 15A and 15B illustrate views of another embodiment of a toothpaste holding section 1500. FIG. 15A is an exploded view of toothpaste holding section 1500. Toothpaste holding section 1500 has a cylinder 1501 that receives plunger assembly 1520 also shown in an exploded view. Plunger assembly 1520 comprises plunger head 1505 with threaded section 1504, plunger sleeve 1503, and plunger shaft 1506 coupled to knob 1508. Threaded shaft 1506 mates with threaded section 1504. Plunger sleeve 1503 goes inside and couples to cylinder 1501 with flange 1507. Knob 1503 has features that snap over flange 1507 so that knob 1508 and sleeve 1503 are attached to cylinder 1501. While knob 1508 is firmly attached to cylinder 1501 it is free to rotate. When knob 1503 is rotated, the threads on shaft 1506 laterally move plunger head 1502. Plunger head 1502 has a compliant seal 1505 that circumferentially contacts against the walls of cylinder 1501. As plunger head 1502 is moved laterally by rotating knob 1503, it operates to pull a vacuum or to pressurize cylinder 1501.

FIG. 15B is a partial assembly view of plunger assembly 1520 coupled to knob 1508 and assembled into plunger sleeve 1503. View 1510 is an end view of this assembly showing the end profile of plunger sleeve 1503, shaft 1506, and twist knob 1508. Plunger sleeve 1503 fits into plunger head 1505 and the threads of shaft 1506 are threaded into threads 1504 forming plunger assembly 1520. Arms 1509 prevent sleeve 1503 from rotating with respect to chamber 1501.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.